

SEA LEVELS AND ABORIGINAL OYSTER MIDDEN AT LAKE CONNEWARRE, VICTORIA, AUSTRALIA

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ABSTRACT: Lower Pliocene basalt flows have created a series of lakes and swamps near the mouth of the Barwon River. No measurable earth movements have occurred since the Last Interglacial, because widespread estuarine beds of that age are horizontal, and their surface stands at +7 m as on the stable Warrnambool platform. Around the lakes and swamps are mid-Holocene terraces that contain mollusc species requiring greater salinity, including oysters. These emerged beds are evidence of a higher sea level.

It has long been held that Aborigines harvested oysters only in East Gippsland and along the east coast of Australia. In this paper a large oyster midden about 1 m thick on Campbell Point in Lake Connewarre is described. Others in the same district occur at North Shore and Batesford, and another occurs near Warrnambool in S.W. Victoria.

At a depth of 0.76 m (not the base) a large *Anadara* valve dated 5270 years B.P. (corrected), the time of the mid-Holocene higher sea level, was collected; while at the surface of the Campbell Point midden an oyster valve dated 3620 years B.P. (corrected) was found. The latter marks approximately the time when oyster harvesting ceased after a long tradition of some two millennia. As the whole fauna requiring a higher salinity than now died out at about this time, the change is attributed to fall in sea level.

When Coulson (1933, 1935) described the sediments, fossils, biology and archaeology of the Lake Connewarre-Reedy Swamp system near the mouth of the Barwon River in Central Victoria, he became the first to describe in detail a Quaternary formation in Victoria. To understand his contribution it is necessary to review the background against which it was written. Scientific attitudes in the 1930s were still those inherited from the United Kingdom, where most scholars had their origins, and where nearly all Ph.D. degrees were taken. Charles Darwin said that the Diluvium (virtually the Pleistocene) was "never studied" until the Ice Age was discovered (F. Darwin 1887, p. 250). No comparable glacial deposits occur in Victoria, so it was common to neglect the Quaternary. A comment often heard in the 1930s in Victoria was "Geology ends with the Pliocene."

Assumptions accepted without question at the time of Coulson's writing, but now known to be erroneous were:

1. *Eustasy does not occur.* Although the idea was put forward in 1842, it was slow of acceptance. The emerged shell beds at Lake Connewarre and the deep channel under the Moolap flats were explained by earth movements, as were the deep channels cut by rivers during low sea levels. Coulson could explain such features only by folding and warping.
2. *Laterite does not occur as far south as Victoria.* Thus Coulson had difficulty explaining the extensive ironstones in his study area.
3. *Aborigines in central Victoria did not harvest oysters.* At that time the antiquity of the Aborigines was surmised to be about 4000 to 6000 years at the most. They were considered to have had one culture, and not a series of cultures as had been described in Europe. Coulson's record of two oyster middens at Lake Connewarre was not accepted. It was commonly thought that he had confused emerged shell beds

with middens, which was then a common error (hence Gill 1950). However, to our knowledge, no one checked his claim in the field.

ORIGIN OF LAKE CONNEWARRE

Coulson (1933, 1935, 1938, 1977) showed that the complex of flood plains, lakes and swamps that characterizes the course of the Barwon River from Geelong to the sea is due to a series of lava flows. It is now known that the complex is also due to eustatic changes of sea level that have alternately caused the sea to invade the area, and then by retreating to lower base level so as to cause overdeepening of stream channels. The latest retreat of the sea that has shallowed the lakes and left terraces around them was not caused by earth movements, because the extensive Last Interglacial estuarine beds (Gill and Collins 1983) are at the same +7 m level as on the stable Warrnambool block.

ORIGINAL CONDITION OF LAKE CONNEWARRE

To understand the facies changes in Lake Connewarre, it is helpful to learn what the area was like under natural conditions before European occupation. Frances Balfour-Melville (1984) lived in the area in the second half of last century. Her father bought land on the lake about 1863 and built a homestead called "Toorang", where she lived until married in 1890. An illustration in her paper shows well-vegetated land bordering the lake north of Campbell Point (Fig. 1). The water was shallow with a black mud floor. Regattas were held there until mud deposition due to clearance of the Barwon catchment and mining activities in the headwaters of the Leigh River (P. F. B. Alsop pers. comm.) caused shallowing and increased weed growth, which forced abandonment of the regattas. Coulson (1935, p. 2) states that when he was working there the depth of water in the middle of the lake was "four feet" (1.22 m) but originally was "seven feet" (2.13 m). In the half cen-

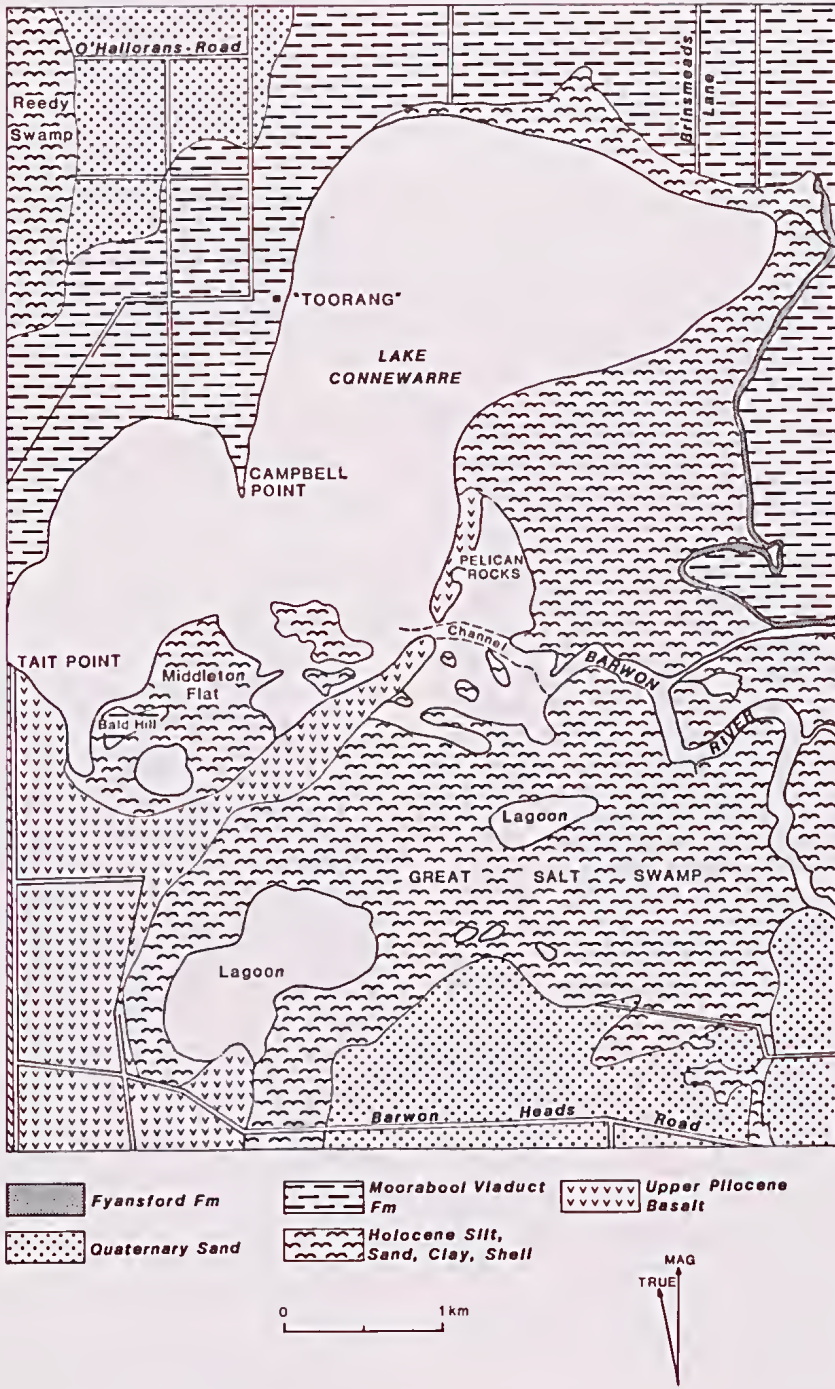


Fig. 1—Map of the Lake Connearre area, adapted from Coulson (1935).



Fig. 2—Telephoto of the east side of Campbell Point, Lake Connewarre, Victoria. The top of the rounded hillock at the tip is the oyster (*Ostrea*) midden with *Anadara*. Note the emerged terrace of mid-Holocene age formed when sea level was higher. The point consists of Moorabool Viaduct Formation (late Miocene). The rocks outcropping in the lake are late Miocene. E. D. Gill photo.

tury since Coulson did his extensive work on Lake Connewarre, further deposition has occurred. Coulson gave the tidal range as “30 inches” (0.76 m). Campbell Point is 8 km in a direct line from the sea at Barwon Heads, and much further along the waterway, which has changed from time to time.

EXTANT AND MID-HOLOCENE FAUNAS IN LAKE CONNEWARRE

Coulson (1933, p. 16) listed the molluscs found living then in the Barwon River-Lake Connewarre system. The facies range from the open sea rocky substrate species at the mouth (e.g. *Subnivalia undulata*) to estuarine species (e.g. *Notospisula parva*). Lake Connewarre is presently brackish, but almost fresh during floods. With up to 1 m of mud deposited on the floor since European occupation, it is difficult to collect the mid-Holocene fauna, but at some sites shells have been washed out of the terrace sediments, and are found on the beaches. For example, on the lake shore at the end of Brinsmead Lane, shells collected included *Anadara*, *Ostrea*, *Katylisia*, *Cabestana*, *Cominella*, *Bullaria*, *Nassarius*, *Polinices* and *Velacunantus*. Bay and inlet conditions must have obtained for genera like *Cabestana*, *Ostrea*, *Katylisia* and *Cominella* to thrive. The relict cliff at the end of Brinsmead Lane consists of the Moorabool Viaduct Formation, so the shells have not come from there, and must be from the low terrace on which the boat ramp and other facilities are constructed. The

geological maps (Coulson 1935, Spencer Jones 1963) show the wide extent of this terrace, which is part of the former lake floor. The terrace occurs on both sides of Campbell Point (Figs. 2, 3), and is a function of the widespread mid-Holocene higher sea level, as studied in detail at Warrnambool and Scaspray (Gill and Lang 1982).

Care has to be taken in interpreting faunas from this terrace, because in some places the terrace has been formed in front of a cliff of similar sediments with the same species, but Last Interglacial in age, so that Last Interglacial fossils can mingle in the terrace with Holocene specimens of the same species.

For example, *Anadara trapezia* shells excavated from the Holocene terrace at the west end of O'Hallorans Road in the N.E. sector of Reedy Swamp gave a false radiocarbon date. Five unworn and chemically reduced shells of this species which could not be distinguished from one another in preservation were found to be partly Holocene and partly Last Interglacial because they dated $16\,580 \pm 190$ years b.p. Three shells were used for the assay, and Dr. M. Barbetti who made the dating (SUA-2072), pointed out that “one Holocene valve about 7 200 years and two Last Interglacial valves would account for the above result”. At this site there is a Last Interglacial cliff behind the Holocene terrace (Gill and Collins 1983) with oxidized *Anadara* shells. Apparently in these very low energy waters, *Anadara* shells were washed out of the cliff and included in the black



Fig. 3—Telephoto of the west side of Campbell Point, Lake Connemara. The top of the domed hillock at the tip with the tree shadow on it is the oyster (*Ostrea*) midden with *Anadara*. Neither genus now lives in the lake. Note the equal development on this side of the point of the mid-Holocene terrace formed by a higher sea level. The trees near the shore are paperbarks (*Melaleuca*); they once lined the entire shore, so the midden site under natural conditions was not as bare as now. E. D. Gill photo.

Holocene mud which chemically reduced them so that they could not be distinguished visually from the Holocene ones. Because of the low energy conditions, none of the shells is worn.

Although Reedy Swamp (formerly a lake) is further from the sea than Lake Connemara, its mid-Holocene fauna has the same bay/inlet genera found in Lake Connemara. A collection was excavated at the south end of Whites Lane, where there is no cliff of Last Interglacial sediments from which re-cycled fossils could come.

EFFECTS OF SEA LEVEL CHANGES

The peak of the last rise of sea level was about 6000 years ago in Australia (Gill 1971, Gill and Hopley 1971, Thom and Chappell 1975). Precision boring and surveying at Warrnambool in Western Victoria and Seaspray in Eastern Victoria (Gill and Lang 1982) has shown that the peak sea level was at about +2 m approximately 6000 years ago, and that this was followed by an oscillation at about +1 m approximately 4000 years ago. That this latter was an oscillation and not simply a fall in sea level is shown by the fact that the 6000 year bed was eroded before the 4000 year one was emplaced (e.g. Gill and Lang 1982, fig. 10). The 6000 and 4000 year phases have been recognized in a number of places.

With the anthropogenic mud bed added since European occupation, it is difficult to sample the underlying shell beds at Lake Connemara. So in order to date when the sea retreated enough from the lake to cause the

demise of the *Ostrea* and *Anadara* beds a different approach was devised, viz. to determine when the Aborigines ceased harvesting these molluscs from the lake.

Ostrea-Anadara MIDDEN, CAMPBELL POINT

Campbell Point, where in 1935 Coulson recorded an oyster midden (which also contains some *Anadara*), is a narrow promontory of Moorabool Viaduct Formation sediments (clayey sand). Coulson (1935), Mulder (1904) and Staeh (1933) have recorded Tertiary marine fossils at this locality, preserved as casts and molds, from about "eight feet above high water mark." The tip of Campbell Point is an isolated circular hillock with cliffed sides standing well above the lake (Figs. 2, 3). It was an island or almost an island when the sea stood 2 m higher. The top of the hillock is a midden consisting of vast numbers of oyster shells, and also many *Anadara* shells, but *Ostrea* predominates. Charcoal is present and a pebble tool and two pieces of flint were found. It is an ancient midden because cliffing has made the sides of the midden continuous with the profile of the hillock. There is also some weathering and juvenile soil formation at the surface. The midden represents a long period of time because it is at least a metre deep and has become compacted. These conclusions were tested by radiocarbon dating.

We were assisted by the owner of the property, Mrs. Nancy Matthews and her son, Mr. Murray Matthews,

who said that when digging rabbits out of the midden, he sank a hole "three feet deep" without reaching the bottom. As further evidence of midden structure, it can be seen that the shells are in relatively random orientation, and not in the flat position of shells in water-deposited beds. The midden is too high to be a Holocene marine deposit. There has been human selection of the shells, as they are all of edible sizes and of virtually two species only. Search found only one shell of any other species, viz. a *Pleuroploca*.

From the point of view of sea level studies, this midden provided an opportunity to determine when the Aborigines were last able to harvest oyster shells in Lake Connewarre.

RADIOCARBON DATINGS

1. One large *Anadara* valve from approximately 0.76 m deep in the midden dated 5720 ± 80 yr b.p., or 5270 yr B.P. (SUA-2153) (b.p. in lower case indicates an uncalibrated date; subtracting the seawater age of 450 years gives 5270 yr B.P.).
2. One large *Ostrea* valve from just below the grass dated 4070 ± 80 yr b.p., which is 3620 yr B.P. (SUA-2152). Samples were collected by L.N.L.

Thus *Ostrea* and *Anadara* flourished during the peaks of higher sea level about 6000 and 4000 years ago (Gill and Lang 1982) when the sea had access to Lake Connewarre. After some two millennia (the C14 date is not of the base of the midden), the Aborigines ceased their very long tradition of harvesting oysters. Some explanation is necessary. Not only *Ostrea* but the whole fauna of molluscs requiring a higher salinity disappeared from the lake. It has already been shown that earth movements are not the cause. Nor is change in the sedimentary regime, because this is held tightly within the bounds of the basal flows. Retreat of the sea is the explanation and 3620 yr B.P. dates the demise of the oyster population because Victorian Aborigines were not a sea-going people, so did not harvest them from offshore.

Coulson (1935) recorded a second oyster midden at Fishermens Point, but this appears to have been destroyed by cultivation.

Ostrea/Anadara MIDDENS AT BATESFORD AND NORTH SHORE

Australian Portland Cement Limited, who work the quarry in Tertiary limestone at Batesford, N.W. of Geelong, kindly permitted us to quote a report prepared for them by the La Trobe University Archaeological Consultants (1982). Ten Aboriginal Sites were found on the company's property, one of which contained *Ostrea* and *Anadara* along with the core tool implements that indicate antiquity. It is the only midden of the group situated west of the Moorabool River. The estuary of Cowic Creek in Geelong was the nearest place these shellfish could be harvested. During the higher sea level they also occurred in Hovell Creek a little further north (Gill 1972). Of the many shellfish available, the

Aborigines harvested only two species. Meehan (1982) describes how contemporary Aborigines of the Blyth River in the Northern Territory collect 29 species including *Ostrea* and *Anadara*. However, in the same area are relict middens belonging to the "Dreaming" that contain many fewer species with *Ostrea* and *Anadara* absent.

In Moorpanyal Park, North Geelong, on the cliff top opposite the corner in the Espanade, there is a large midden with *Ostrea*, *Anadara*, *Mytilus* and *Eumarcia*. This midden has not been dated and the shells come from Corio Bay which is deeper than Lake Connewarre, and so has not been affected in the same way by fall of sea level.

ABORIGINAL OYSTER HARVESTING

Until recently Aboriginal oyster middens were believed to be limited to east Gippsland. "P. J. F. Coultts has investigated and dated middens containing *Ostrea* at Wilsons Promontory, while K. Hotchkin has mapped and dated *Ostrea* and *Anadara* middens at Jaek Smith Lake" (Hotchkin in litt.). So the record of oyster middens in the Geelong district is of great interest, but there is also a record from the Warrnambool district in S.W. Victoria. Samuel Hannaford (1860) recorded a mass of oyster shells on top of a hill at Tooram, on the Hopkins River estuary 9 km from the mouth. Dr. John Sherwood of the Warrnambool Institute of Advanced Education and E.D.G. had no difficulty locating the site, and there was evidence of Aboriginal occupation, but the midden had been destroyed by cultivation like that on Fishermens Point at Lake Connewarre. Mr. B. Logan, the property owner, said he had been told about this oyster midden, and another on the opposite side of the river, but he had not seen them himself. The Aborigines who harvested the oysters could have obtained them only from the river. So Sherwood and Gill, assisted by C. Magilton, tested a low terrace below the hillock midden site. An auger hole located a shell bed with oysters at a depth of about one metre. The shell bed was then seen at about the same depth in the banks of the Lake Gillcar drain that enters the river nearby. This bed also had oysters, as did the drain spoil heaps, and must be the source of the oysters utilized by the Aborigines. The shells were dated 5900 ± 70 yr b.p. or 5450 yr B.P. (SUA-2203). For oysters to grow in the river 9 km from the present mouth would require a higher sea level.

Thus Aborigines in the past harvested oysters in Central and Western Victoria, but have not done so in recent times. Holocene oyster beds are common around the coast of Victoria, so a search of such areas for ancient Aboriginal oyster middens could be rewarding.

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